

REMARKS

Applicants appreciate the continued thorough examination of the present application as evidenced by the Office Action of October 24, 2008 ("Office Action"). In the Office Action, Claims 1-4 and 6-16 were rejected as anticipated by U.S. Patent No. 5,570,332 to Heath et al. ("Heath"). Applicants have amended Claims 1, 8 and 11 extensively to clarify the patentability of these claims over Heath. Accordingly, Applicants respectfully submit that the claims are patentable for at least the reasons discussed below.

I. Interview Summary

Applicants appreciate the courtesy extended by Examiner Tsai in the telephonic interview of January 16, 2009 with the undersigned representative. The parties discussed proposed amendments to Claim 1 and the applicability of Heath to the claims. No agreement was reached.

Applicants respectfully request that the above remarks constitute an Interview Summary pursuant to MPEP §713.04.

II. The Independent Claims Are Patentable Over Heath

Claim 1, as amended, recites as follows (emphasis added):

1. A method of selecting a target destination from among first and second target destinations, the method comprising:

determining first and second preliminary seek lengths between a source cylinder on a data storage disc corresponding to a source head and target cylinders on the data storage disc corresponding to the first and second target destinations based on lateral distances from the source cylinder to the target cylinders;

generating a first adjusted seek length for the first target destination and a second adjusted seek length for the second target destination by adjusting the first and second preliminary seek lengths using respective lateral offset indicators that represent offsets in the lateral distance of target heads from the target cylinders relative to the first and second preliminary seek lengths and that are generated in response to a longitudinal position measurement of the source head; and

selecting the target destination in response to the first and second adjusted seek lengths.

Claim 1 relates to selection of a target destination from among first and second target destinations. As will be understood, in a servo-controlled data storage device, such as a disc drive, a plurality of disc access commands, such as read commands and write commands, can be received by a disc controller unit from a host CPU. Each disc command specifies a target destination on a data storage surface of a disc in the disc drive. Thus, each command may specify a cylinder, head and sector at which data is to be read or written. Disc access commands are illustrated, for example, in Figure 10 of the present application.

A source location, specified by a source head, source cylinder and source sector, represents a current location of a disc head that is performing a previous disc access command. In the example illustrated in the present specification at page 16, line 6 to page 19, line 5, the source location corresponds to disc head 2, cylinder 31000 and sector 44. That is, in the example, the disc drive has just completed a read/write operation at cylinder 31000 and sector 44 of the disc surface corresponding to disc head 2. As illustrated in Figure 10, a number of potential disc access commands, specified by target head, target cylinder and target sector, could be chosen for execution after the execution of the command at the source location.

In a method according to Claim 1, as amended, first and second preliminary seek lengths are determined for first and second target destinations. The first and second preliminary seek lengths represent distances "between a source cylinder on a data storage disc corresponding to a source head and target cylinders on the data storage disc corresponding to the first and second target destinations based on lateral distances from the source cylinder to the target cylinders." Thus, for example, the preliminary seek lengths may represent the number of cylinders between the source cylinder and the target cylinders. Preliminary seek lengths are discussed, for example, at page 14, lines 6-15 of the Specification. As stated therein:

A disc stack rigidly supporting at least two pre-written data storage discs is constructed 610 and arranged into a disc drive so that "reference" (source) and (available potential) "target" heads can access data surfaces of the discs. A cylinder, head and sector numbers are determined for the reference head 615 and for the target heads obtained from several queued commands 625. Differences are computed

between the reference cylinder number and each of the target cylinder numbers, generating a preliminary seek length for each of several queued commands 630.

For example, returning to the example discussed in the Specification at page 16, line 6 to page 19, line 5 and illustrated in Figure 10, the disc controller unit may have a command 1013 and a command 1014 queued for execution. The command 1013 specifies a target location of head 0, cylinder 30973 and sector 69, while the command 1014 specifies a target location of head 1, cylinder 31022 and sector 78. A first preliminary seek length is therefore -27 tracks, i.e., the distance between the source cylinder (31000) and the target cylinder of the command 1013 (30973), while a second preliminary seek length is 22 tracks, i.e., the distance between the source cylinder (31000) and the target cylinder of the command 1014 (31022).

However, according to Claim 1, before a potential command is selected for execution, the seek length of each seek is adjusted to take into account the fact that there may be some offset between the location of the source head (head 2) and the location of a target head (head 0 or 1). That is, while the source head is track-following on the source cylinder 31000, the target heads may be offset laterally (i.e., radially) from the source cylinder, potentially by many track widths.

This offset is illustrated, for example, in Figures 3 and 4 of the present application. For example, Figure 3 illustrates that the disc heads 195, 295 may be physically offset from one another by an offset 197 in the lateral (i.e., radial) direction. Thus, for example, while disc head 295 is in track-following mode while performing a read/write operation on a source cylinder, the other disc head 195 may be offset from the source cylinder (and therefore closer or farther away from a potential target cylinder) by the offset 197. Figure 4 illustrates that the offset can change with longitudinal (i.e., circumferential) position of the head as it passes over the disc surface, because, for example, the disc tracks on different discs may have centers that are not aligned. Thus, the offset of a target head from the target cylinder may change with longitudinal position of the head as it traverses around the disc.

Accordingly, Claim 1 recites "generating a first adjusted seek length for the first target destination and a second adjusted seek length for the second target destination by adjusting the first and second preliminary seek lengths using respective lateral offset indicators that represent offsets in the lateral distance of target heads from the target cylinders

relative to the first and second preliminary seek lengths and that are generated in response to a longitudinal position measurement of the source head." (Emphasis added).

That is, the first and second preliminary seek lengths are adjusted to account for lateral offsets in the distance of the target heads to the respective target cylinders. As further discussed in the illustrated example, although the command 1013 is nominally an inward seek of 27 tracks (preliminary seek length = -27 tracks), it is actually more like an outward seek of about 6 tracks (adjusted seek length = +6.3 tracks). See Specification, page 18, lines 16-25. This information can be used by the disc controller unit to make more accurate decisions regarding the order of execution of commands.

Turning to the rejection of Claim 1 as anticipated by Heath, Applicants respectfully submit that Heath does not disclose at least "generating a first adjusted seek length for the first target destination and a second adjusted seek length for the second target destination by adjusting the first and second preliminary seek lengths using respective lateral offset indicators that represent offsets in the lateral distance of target heads from the target cylinders relative to the first and second preliminary seek lengths and that are generated in response to a longitudinal position measurement of the source head" or "selecting the target destination in response to the first and second adjusted seek lengths."

Heath is also directed to methods of selecting a disc access command for execution from among a plurality of queued disc access commands. According to Heath, a rotating medium (i.e. a disc) is divided into a plurality of discrete angular regions. For each discrete angular region, a number of cylinders that may be traversed by a data retrieval element (i.e., a head) during a single revolution of the disc is identified. A rotational latency is assigned to each discrete angular region based on a current location of the head. A command queue array is searched for a command that addresses a location within a range of cylinders determined by the number of cylinders in the discrete angular region having the smallest rotational latency. Heath, Abstract. The method of Heath is illustrated, for example, in Fig. 2 thereof, which is reproduced below for convenience.

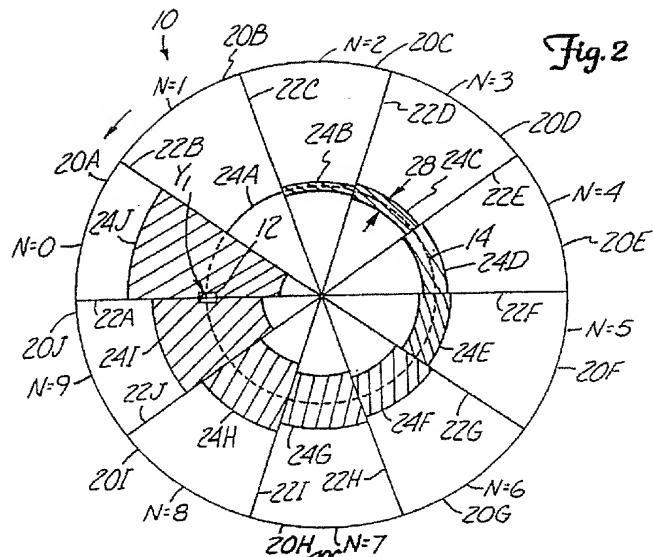


Fig.2

As shown therein, a read/write element (i.e., head) 12 is located over a rotating disc 10. Heath, col. 3, lines 49-51. The head 12 is located over a cylinder path 14 ("Cylinder path 14 (represented by a dashed line) is the current track or cylinder over which read/write element 12 is located.") Heath, col. 3, lines 53-55. In the illustration of Fig. 2 of Heath, the disc 10 is rotating in a counter-clockwise direction. The disc 10 is divided up into a plurality of discrete angular regions 20A-20J. Within each discrete angular region, a cylinder range shown as a shaded region 24A-24J graphically indicates the minimum number of tracks within that region that can be traversed within a single rotation of the disc. Heath, col. 6, lines 43-46. Thus, for example, as the disc 10 passes under the head 12, the head can move to access any track within region 24B in the angular region 20C within a single disc rotation. The method of Heath then searches the command queue for a command having a command address within the cylinder range 24 associated with the discrete angular region having the smallest rotational latency. Heath, col. 6, line 66 to col. 7, line 3.

Applicants note, however, that the method of Heath does not take into account the fact that a source head and potential target heads may actually be located over different cylinders. That is, the cylinder ranges 24A-24J of Heath are based only on current location of the head 12, i.e., the cylinder path 14, or source location. When calculating the cylinder ranges 24A-24J, Heath does not adjust the ranges for source/target head offset. Accordingly, Heath does not disclose or suggest at least "generating a first adjusted seek length for the first target destination and a second adjusted seek length for the second target destination by adjusting

the first and second preliminary seek lengths using respective lateral offset indicators that represent offsets in the lateral distance of target heads from the target cylinders relative to the first and second preliminary seek lengths," as recited in Claim 1. Moreover, Heath does not disclose or suggest (1) adjusting seek lengths based on lateral offset indicators that are generated in response to a longitudinal position measurement of the source head, or (2) selecting a target destination in response to such adjusted seek lengths. Claim 1 is therefore submitted to be patentable over Heath.

Similarly, Claim 8 has been amended to recite "wherein the first and second adjusted seek lengths are generated by adjusting first and second preliminary seek lengths that represent respective lateral distances from a source cylinder to first and second target cylinders corresponding to the first and second target destinations in response to corresponding lateral offset indicators that represent offsets in the lateral distance of the first and second target heads from the first and second target cylinders relative to the first and second preliminary seek lengths and that are generated in response to a longitudinal position measurement of a source head."

Claim 8 is therefore submitted to be patentable over Heath for at least similar reasons as Claim 1.

Finally, Claim 11 has been amended to recite "generating estimates of first and second seek lengths that represent lateral distances of first and second target heads to respective first and second target cylinders for queued disc access commands by adjusting first and second preliminary seek lengths that represent lateral distances from a source cylinder to the first and second target cylinders to compensate for lateral offset present between a source head that performed a previously executed disc access command and the first and second target heads."

Claim 11 is therefore also patentable over Heath for at least similar reasons as Claim 1.

III. The Dependent Claims Are Allowable

Applicants traverse the rejection of the dependent claims. However, as each of these claims depends from a base claim that is believed to be in condition for allowance, Applicants do not believe that it is necessary to argue the allowability of each dependent claim individually. Applicants do not necessarily concur with the interpretation of these claims, nor with the bases for rejection set forth in the Office Action. Applicants therefore reserve the right to address the patentability of these claims individually as necessary in the future.

CONCLUSION

Again, Applicants appreciate the continued thorough examination of the present application. In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is now in condition for allowance. Favorable reconsideration of this application, as amended, is respectfully requested. If, in the opinion of the Examiner, a telephonic conference would expedite the examination of this matter, the Examiner is invited to call the undersigned attorney at (919) 854-1400.

Respectfully submitted,



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